

- the width of the sand filter. The downstream lip of the sump shall be no more than 8 inches above the top of the sand bed.
5. Flows shall enter the sand bed by **spilling over the top of the wall into a flow spreader pad**, or alternatively a **pipe and manifold system** may be designed and approved at the discretion of DDES to deliver water through the wall to the flow spreader. *Note: Water in the first or presettling cell is dead storage. Any pipe and manifold system designed must retain the required dead storage volume in the first cell, minimize turbulence, and be readily maintainable.*
 6. If a pipe and manifold system is used, the **minimum pipe size** shall be 8 inches. Multiple inlets are recommended to minimize turbulence and reduce local flow velocities.
 7. **Erosion protection** shall be provided along the first foot of the sand bed adjacent to the spreader. Geotextile weighted at the corners with sand bags, quarry spalls, or other suitable erosion control may be used.

Overflow and Bypass Structures

Same as for sand filters (see page 6-112).

Filter Composition

The filter bed shall consist of three layers as follows:

- Top layer: sand
- Second layer: geotextile fabric
- Third layer: underdrain system.

Sand Specifications and Geotextile Materials

Same as for sand filters (see page 6-113).

Underdrain Systems and Underdrain Materials

Same as for sand filters (see page 6-114).

Vault Structure

1. Sand filter vaults are typically designed as on-line (flow-through) systems with a flat bottom under the filter bed.
2. If a presettling cell is provided, the **cell bottom** may be longitudinally level or inclined toward the inlet. To facilitate sediment removal, the bottom shall also slope from each side towards the center at a minimum of 5%, forming a broad "v." *Note: More than one "v" may be used to minimize cell depth.*
Exception: The bottom of the presettling cell may be flat rather than v-shaped if **removable panels** are provided over the entire presettling cell. Removable panels shall be at grade, have stainless steel lifting eyes, and weigh no more than 5 tons per panel.
3. One foot (average) of **sediment storage** must be provided in the presettling cell.
4. Where pipes enter and leave the presettling cell below the WQ design water surface, they shall be **sealed** using a non-porous, non-shrinking grout.
5. If an **oil retaining baffle** is used for control of floatables in the presettling cell, it must conform to the following:
 - a) The baffle shall extend from 1 foot above to 1 foot below the WQ design water surface (minimum requirements) and be spaced a minimum of 5 feet horizontally from the inlet.
 - b) Provision for passage of flows in the event of plugging shall be provided.

- c) An access opening and ladder shall be provided on both sides of the baffle into the presettling cell.
- 6. Sand filter vaults shall conform to the "**Materials**" and "**Structural Stability**" criteria specified for **detention vaults** in Section 5.3.3.
- 7. The **arch culvert sections** allowed for wetvaults **shall not be used** for sand filter vaults. Free access to the entire sand bed is needed for maintenance.

Access Requirements

Same as for **detention vaults** (see Section 5.3.3) except for the following **modifications**:

- 1. For facilities maintained by King County, removable panels must be provided over the entire sand bed. Panels shall be at grade, have stainless steel lifting eyes, and weigh no more than 5 tons per panel. Concrete bridge decking or industrial decking are options. If within the roadway, the panels must meet the traffic loading requirements of the King County road standards.
- 2. A minimum of 24 square feet of ventilation grate must be provided for each 250 square feet of sandbed surface area. Grates may be located in one area if the sand filter is small, but placement at each end is preferred. Small grates may also be dispersed over the entire sand bed.

Intent: Grates are important to allow air exchange above the sand. Poor air exchange will hasten anoxic conditions which may result in release of pollutants such as phosphorus and metals and cause objectionable odors.

Access Roads, Right of Way, and Setbacks

Same as for detention vaults (see Section 5.3.3).

Recommended Design Features

The following design features should be incorporated into sand filter vaults where feasible but are not specifically required:

- 1. The **floor of the presettling cell** should be **sloped toward the inlet** to allow for sediment accumulation and ease of cleaning.
- 2. A **geotextile fabric** is recommended over the sand bed to make sand bed maintenance easier. If used, the geotextile should be a flexible, high-permeability, three-dimensional matrix of the kind commonly used for erosion control. Sand bags should be used at 10 to 15 foot intervals to hold the geotextile in place.
- 3. **Additional grates** are recommended instead of solid panels to increase air contact with the sand bed.

Construction Considerations

Same as for sand filters (see page 6-117) plus, upon completion of installation, the vault shall be thoroughly cleaned and flushed prior to placement of sand and drain rock.

Maintenance Considerations

Maintenance considerations for sand filter vaults are similar to those described for sand filters (see p. 6-118). Maintenance practices need to be modified somewhat due to the sand filter being in a vault, including the use of safe confined space entry procedures.